

OBSERVATIONS ON THE GENUS *RETICULITERMES*
HOLMGREN

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The following observations were made chiefly at the University of California between the autumn of 1928 and the early part of the present year, 1932. Some of the findings appear to differ in important aspects from those of previous workers.

The genus *Reticulitermes* occurs in a broken circle around the earth, almost altogether in the temperate zone, except for extensions along mountain ranges or cooler seacoasts. The range for the genus appears to be limited on the north by temperatures too cool for breeding, and on the south by temperatures too warm, queens being inclined to an æstival as well as a hibernal surcease from egg laying. Ranges for the species seem to be determined also by differences in humidity. In the Nearctic the ranges of the three chief species correspond roughly to the three subregions of Wallace's "Geographical Distribution of Animals" (1876). Comparative studies show that even the dry wood termite *Kalotermes minor* Hagen is most abundant near mild foggy seashores, somewhat common inland near large streams and lakes, and absent from the dryer areas, decrease being proportional to moisture content in the air.

Observations made chiefly on *Reticulitermes hesperus* Banks bring out the following points: Infestation rarely takes place through flying pairs, but usually occurs through the ground, from insects which, after migrating, have a supplementary reproductive pair bred from among their number.

The rarely established primary colony, judging from laboratory and field experience, develops very slowly, the most successful colonies being aggregates of the offspring of several pairs, eventually collected under a single pair, that survived the conflict incident to such groupings.

Colony increase in the primary colony, as observed in the laboratory and field, is a very slow process, few eggs being deposited the first year, usually about twelve, and these eggs require on the average more than fifty days for hatching. The *first* eggs hatch in little more than a month after laying, the periods for the others increasing gradually until the last egg may

require almost four months. The worker attains maturity by a series of instars lasting, respectively, approximately one-half, one, two, four, eight and apparently sixteen months. In soldiers and alates the last instar is shortened by several months, and soldiers appear to omit one or more final instars depending on their adult size. First soldiers in primary colonies attain maturity much earlier, and are much smaller in size than soldiers from larger colonies.

The chief factor in general population increase seems to be the brachypterous secondary queen, which reaches the egg-laying period earlier, and lays far more abundantly than either the primary reproductive, or the apterous form, except in rare cases where apterous reproductives have an abundance of retainers. Conjecture both on the part of popular and scientific writers has exaggerated the importance of the winged reproductives.

Theoretically, the queen appears to inhibit passively the full development of additional queens by some secretion from her body on which her attendants feed. Nymphs of groups isolated with reproductives do not develop into functional reproductives, while secondary reproductives do develop in about eight weeks in groups of nymphs and workers isolated without reproductives. Alates appear to develop in a part of the colony at a distance from the cells the queen chiefly inhabits. Every step of intergradation between workers and alates occurs, and some, at least, of the workers appear to be inhibited reproductives capable of developing into apterous queens. Those nymphs most closely in attendance on the queen would appear to be most completely inhibited and to develop into workers.

In the case of a soldier a difference in the egg is indicated. Soldier eggs appear to be laid at considerable intervals after the main group of eggs, and to require longer periods for hatching. Heretofore the inclination has been to classify undifferentiated nymphs into a sterile soldier-worker group and a fertile reproductive group. Indications appear to warrant a new grouping. It would seem better to presuppose a soldier group and a worker-reproductive group, workers supposedly having evolved from primary reproductives through brachypterous reproductives.

Periods of swarming in the eastern humid states appear to be controlled by rise of temperature in the spring, and in the dryer western states by rise in the amount of moisture during autumn. *Reticulitermes hesperus* and its congener *R. tibialis* Banks are strikingly similar in markings and general habits of the colony. The chief difference lies in geographical distribution, reaction to moisture content of soil, and in the degree of pugnacity in the various castes of the two species.

Fertile crossings of *R. hesperus* males with *R. tibialis* females have been accomplished in the laboratory, as has also the fertile crossing of the unpigmented primary with the pigmented in *R. hesperus*.

Numerous experiments fail to show a single case of adoption of a foreign pair, either primary or supplementary, by a group from another colony. Rather they are viciously attacked, their bodies chewed up, mixed with wood pulp and buried on the floor of the burrow, a rude approximation of the embalming process pursued by bees with certain invaders.

Egg numbers in the first clutch of a primary colony run from four to twelve or fifteen. Fertilization of the egg takes place in the female's body. Copulation may occur as early as the next day after swarming, and recurrences take place for months afterwards. Thus the earliest eggs have appeared in twelve days after the swarming of the pair, while with other pairs no eggs were found until the following spring.

There appears to have been a marked increase of *Reticulitermes* population noticeable in recent years, chiefly in the regions of *R. hesperus*. This has been occasioned by the favorable temperature, moisture, and food supplied by modern building, landscaping and other developmental methods. Preventive methods along the lines of proper construction rather than resort to poisons and insecticides appears advisable.

The above constitutes a digest of three papers on *Reticulitermes* read before the meetings of the Association for the Advancement of Science and the Western Society of Naturalists. A detailed report will be published later.